

TU – Kadoorie
Course: Thermodynamics
Date 8-5-2010

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College of Engineering
Second Exam.
Sec. Semester 2009-2010

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Q1: a- Complete the following table using thermodymic tables: (6 marks)

4/6

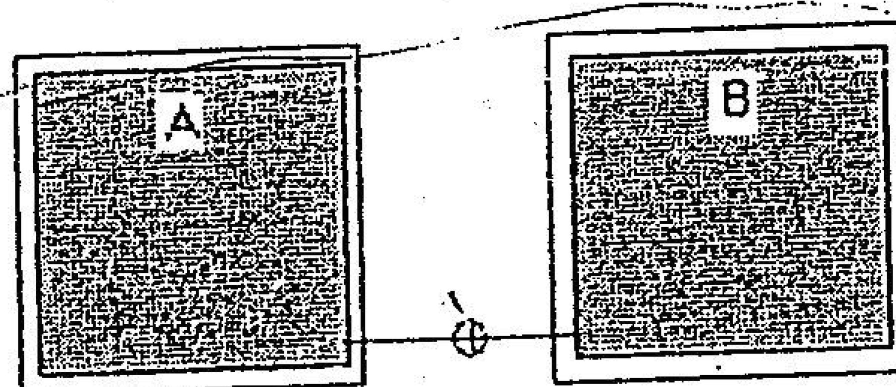
| substance | Tem. (°C) | Pressure (kpa) | Quality (x) | Specific. Volume (v) | Internal energy (u) | Enthalpy (h) | Phase description |
|---|---|---|---|---|---|---|---|
| $H_2O$ | 140 | 361.3 | 0.194 | 0.10 $v_f < v < v_g$ | 969.21 | 1005.19 | Saturated mixture liquid and vapor (two phase) |
| $H_2O$ | 300 | 1200 | 10.47 | 0.21382 | 2789.22 | 3153.59 | Super heated Vapor |
| R-22 | -10 | 150 | 2.51 | 0.16288 | 226.198 | 250.63 | Super heated Vapor |
| Ammonia $NH_3$ | 15 | 600 | 1.241 | 0.216345 | 1301.293 | 1431.1 | Super heated vapor |

$u = h - Pv$

b- Two tanks are connected as shown, both containing water. Tank A is 300 Kpa, $v_A = 0.5$ $m^3/kg$, $V_A = 1\ m^3$. Tank B contains 3.0 kg at 0.6 Mpa and 400 °C. The valve is now opened and the two tanks come to a uniform state. Find the final specific volume. (5 marks)

$v = V/m$

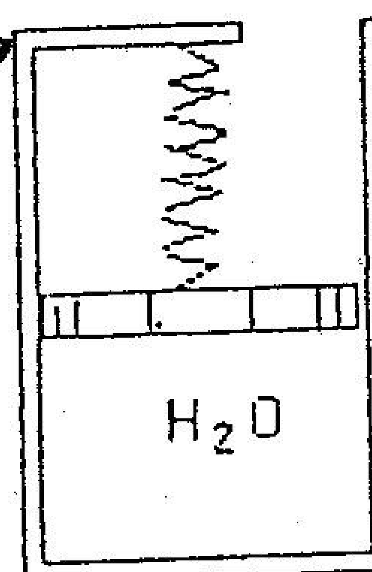
$m_A = 2\ kg$




Q2: a- Air in a piston cylinder arrangement has a pressure that is related to the volume according to the equation P = B + CV with C and B are constants. The initial state of the air P = 150 Kpa, V = 1 L and the final state of P = 800 Kpa and V = 1.5 L. Find the work done by the system. (6 marks)

b- A cylinder having a piston restrained by a linear spring contains 0.6 kg of saturated water mixture at 120 °C, x = 0.20 as shown in the Fig. Heat is transferred to the water, causing the piston to rise, and with a spring constant of 15 kN/m, piston cross-sectional area 0.05 m², the pressure varies linearly with volume until a final pressure of 500 kPa is reached. Find the final temperature in the cylinder and the heat transfer for the process. Show the P-V and T-V diagrams for the process. (8 marks)

تم الرفع بواسطة
م. معن أبو عيسى




ديناميكا حرارية
امتحان ثاني

Good luck

النموذج الأول

F= C+U

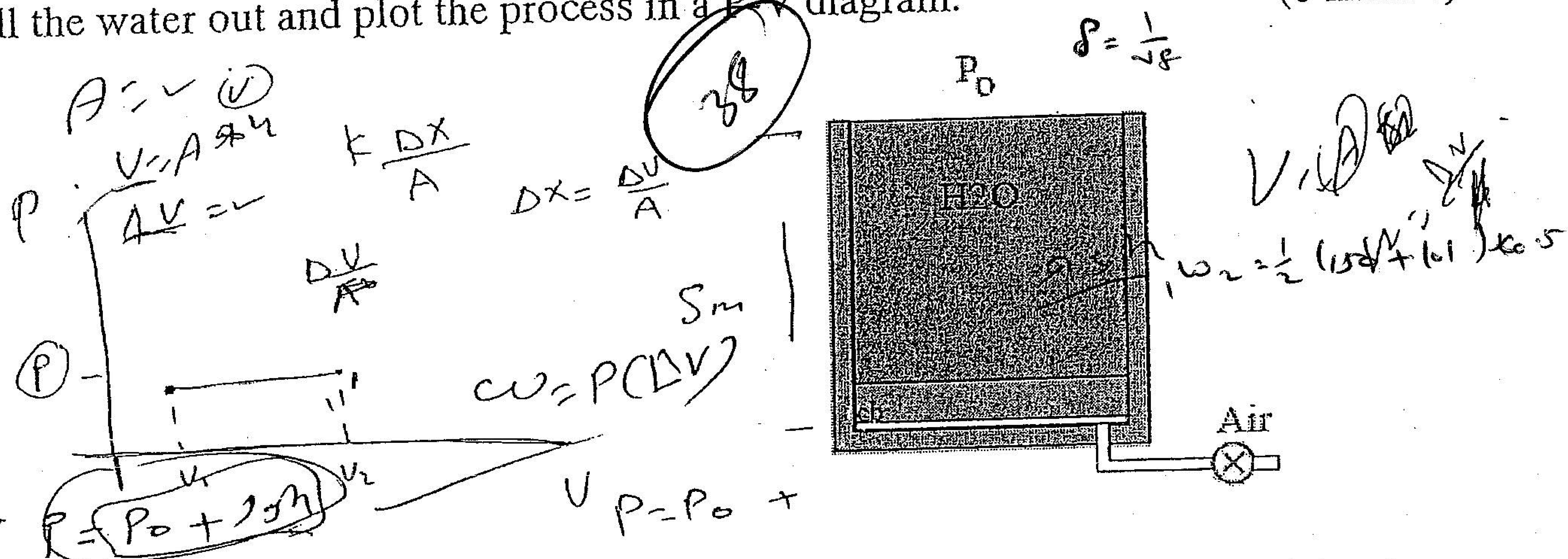


[redacted]T U – Kadoorie
Course: Thermodynamics
Date 23 -12-2010

**College of Engineering**
**Second Exam.**
**First. Semester 2010-2011**

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**Q1:** A piston/cylinder has 5 m of liquid water at 20 $C^0$ on top of the piston ($m_p = 0$) with cross-sectional area of 0.1 $m^2$, Air is let in under the piston that rises and pushes the water out over the top edge. Take the air under the piston as a system Find the necessary work to push all the water out and plot the process in a P-V diagram. **(6 marks)**



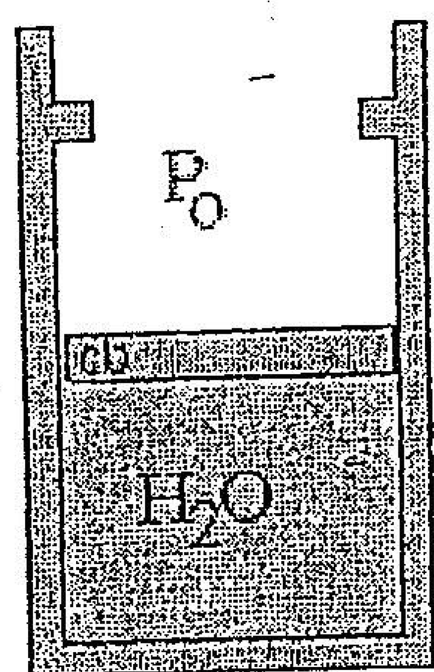

**Q2:** Air at 200 kPa, 30°C is contained in a cylinder/piston arrangement with initial volume 0.1 $m^3$. The inside pressure balances ambient pressure of 100 kPa plus an externally imposed force that is proportional to $V^{0.5}$. Now heat is transferred to the system to a final pressure of 225 kPa. Find the final temperature and the work done in the process assuming ideal gas behavior. **(6 marks)**

تم الرفع بواسطة م. معن ابو عيسى

**Q3: a-** A radiant heating lamp has a surface temperature of 1000 K with emissivity ε = 0.8. What is the surface area of the lamp to provide 25kW of radiation heat transfer? σ = 5.67 x $10^{-8}$ **(4 marks)**

$\dot{Q} = \varepsilon \sigma A T_s^4$

**b-** A piston/cylinder contains 1 kg of liquid water at 20°C and 300 kPa. Initially the piston floats, with a maximum enclosed volume of 0.002 $m^3$ if the piston touches the stops. Now heat is added to a final pressure of 600 kPa.
1- Is the piston at the stops 2- the work in the process. 3- the heat transfer **(9 marks)**




assume the piston not stop of the stop $V_2 < V_s$

$V_s = 0.002 m^3$ / m = 1 kg

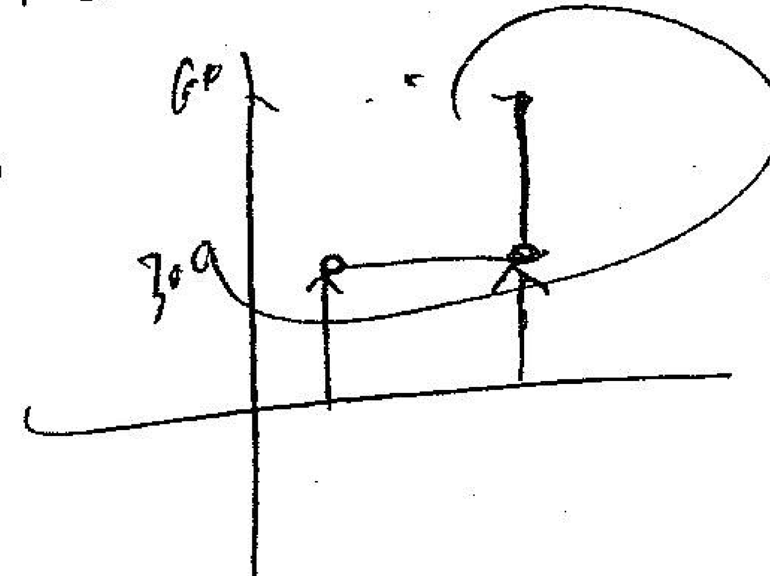
stat 1 $T_1 = 20°$, $P_1 = 300$ kPa — Liquid water

$P_2 = 600$ kPa

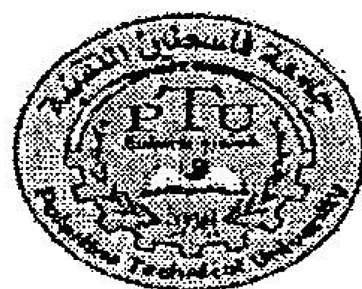
From stat 1 $T_1, P_1$ check

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**Good luck**



النموذج الثاني





تم الرفع بواسطة
م. معن ابو عيسى

ديناميكا حرارية
امتحان ثاني
النموذج الثالث

**Q1: (7 marks)**

A rigid vessel contains 10 kg R-134 at a temperature -20 C° and the volume of the vessel is 0.5 $m^3$. Find the following:

1- The phase of the substance
2- The pressure
3- The specific volume
4- The total internal energy
5- The mass of the liquid phase if the substance is saturated mixture.

**Q2: a- (3 marks)**

Define the following :
Isothermal process, Thermodynamic cycle, polytropic process

**b- (4 marks)**

what are the differences between conduction heat Transfer and convection heat transfer, write the equations used to calculate the rate of heat transfer in both.

**Q3- ( 6 marks)**

A gas initially at 1.0 MPa, 500 C° is contained in a piston and cylinder arrangement with an initial volume of 0.1 $m^3$. The gas is then slowly expanded according to the relation PV = constant until a final pressure of 100 kPa is reached. Determine the work for this process and draw the P-V diagram for this process, assuming ideal gas behavior.

**Q4- ( 10 marks)**

A 2.0 kg Ammonia in a cylinder piston arrangement is at 700 kpa , 80 C° ( state 1 ). It is now cooled at constant pressure process to saturated vapor ( state 2 ) at which point the piston is looked with a pin. The cooling process continues to -10 C° (state 3).

Find:-

1- The final pressure
2- The work done on the system, ${}_1W_3$
3- Show the processes 1-2 and 2- 3 on both a T- v and P - V diagrams.

